Rancho La Costa
Habitat Conservation Area

A Dedicated Natural Open Space System Set Aside as part
of the La Costa Villages, University Commons, and
Cassia Professional Offices Developments
and also includes the "Nelson", "Meadowlark" and "Copper Creek" parcels.

(CNLM No's: S016, S020, S022, S026, S036, S043 & S048)

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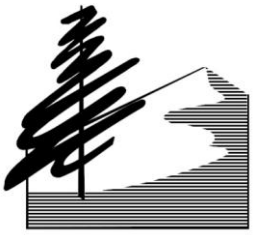

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I. INTRODUCTION

This annual work plan has been developed from the guidelines for goals and objectives set forth in the Habitat Management Plan for the Rancho La Costa Habitat Conservation Area (Plan) (CNLM 2011). The Plan includes management activities that the Center for Natural Lands Management (Center or CNLM) has determined are appropriate to study, protect and maintain the natural resources found on the property. The Center holds fee title and conservation easements (CE) to the Rancho La Costa Habitat Conservation Area (HCA) and performs or oversees the tasks identified in the Plan.

The HCA covers several areas which were dedicated to the Center for long-term management from the La Costa Villages, University Commons, and Cassia Professional Offices (Cassia) developments. Each development dedicated several parcels that have been identified in the past by various names or associations. The La Costa Villages project dedicated parcels referred to as the Oaks, Ridges, Greens, Choumas-Pappas, and Alemir, of which the former three are located in the City of Carlsbad, and the latter two are located in the County of San Diego. The University Commons project dedicated parcels referred to as the "on-site parcels", Frank's Peak, Pfau (CE), Huff, Wilern, Winston, Setter, and Elfin Forest (CE). The Elfin Forest parcels are located both on-site (San Marcos) and within the County of San Diego. The Setter parcel is within the County of San Diego. All the other University Commons parcels are located within the City of San Marcos. The Nelson parcel, located in San Diego County, was purchased by the National Fish and Wildlife Foundation and deeded to the Center. The "Cassia" parcel was added in 2007 and is located adjacent to the "Greens" parcel in Carlsbad. The Meadowlark parcel (acquired via the Environmental Trust bankruptcy) was added in early 2009 and is located in the City of San Marcos between the Wilern and on-site University Commons parcels. In October of 2011, the Copper Creek property was added this HCA. Copper Creek (formerly known as the "Perkins" or "Conservation Fund Unit") was purchased by the Wildlife Conservation Board from the Conservation Fund.

CNLM holds fee title to most parcels, and is also managing properties pursuant to six recorded conservation easements (CE). As of 2011, stewardship funding to manage all of the HCA parcels have been received, except for the Copper Creek parcel, for which partial funding has been received (see budget section). Management commenced in January 2002 for about one half of the total property with management of the additional acreage commencing between January 2002 and early 2009.

The purpose of this work plan is to identify the tasks and budget required to complete the management activities for this fiscal year. The fiscal year encompasses the period from October 1, 2012 through September 30, 2013. Unless otherwise stated, all tasks will be performed by the Center's Regional Preserve Manager, Preserve Manager, Patrick McConnell, Assistant Preserve Manager, Stephen Rink, and Ranger Todd Nordness.

Summary of Tasks and Goals:

- Replace and install signs as necessary. Repair and replace fencing as necessary.

- Note all animal species observed and map locations of any sensitive species.
- Monitor wildlife corridors using digital cameras.
- Conduct vegetation sampling at established plots within the thread-leaf brodiaea (*Brodiaea filifolia*) populations.
- Count individuals, perform a habitat assessment, and control weeds within the San Diego thornmint (*Acanthomintha ilicifolia*) occurrence.
- Collect San Diego thornmint plant material for grant funded genetic studies.
- Collect data from coastal sage scrub (CSS) vegetation monitoring plots.
- Count the Orcutt's hazardia (*Hazardia orcuttii*) transplanted container plants on the Greens and survey for seedlings.
- Remove non-native plant species. Focused attention will be given to: perennial pepper weed (*Lepidium latifolium*), onion weed (*Asphodelus fistulosus*), Ward's weed (*Carrichtera annua*), pampas grass (*Cortaderia* spp.), Italian thistle (*Carduus pycnocephalus*) and tamarisk (*Tamarix* spp.).
- Perform counts and survey for Orcutt's brodiaea (*Brodiaea orcuttii*) at the Winston parcel.
- Coordinate with Homeowner's Associations (HOAs) on HCA issues, coordinate public outreach events and prepare public outreach literature.
- Coordinate with trail volunteers, Eagle Scouts, and the San Diego Mountain Biking Association to accomplish HCA projects.
- Mow and clear fuel breaks.
- Patrol and conduct site enforcement on a regular basis.
- Report and describe data collected and management actions taken on the HCA to the regulatory agencies.
- Conduct CE compliance monitoring and prepare reports.
- Provide an accounting of funds to be spent in the next fiscal year.
- Perform California gnatcatcher (*Polioptila californica californica*) surveys.
- Repair/maintain dirt access roads including, Denning Road and the access road east of Huff/Hidden Canyon.
- Repair/maintain erosion control off El Fuerte road.

Appendix 1 identifies the approximate schedule of field work throughout the fiscal year. Maps of the HCA are located in Appendix 2.

II. MANAGEMENT ACTIVITIES

The following sections identify and describe the activities to be performed during this fiscal year. Based upon the Property Analysis Record© (*PAR*) developed by the Center to outline long-term management tasks and costs, management activities can be categorized into several groups: Capital Improvements, Biological Surveys, Habitat Maintenance and Restoration, Public Services, Reporting, Office Maintenance, and Operations. Each of these categories will be discussed below.

A. CAPITAL IMPROVEMENTS

Fencing, signing, and access road maintenance are the capital improvements to be undertaken during the upcoming fiscal year.

1. Fencing. The Center will construct or repair fencing, as needed, in areas where the public is trespassing or to prevent damages to the HCA.

2. Signing. Center signs have been posted at all of the major access points to the HCA. Additional signs will be installed in other strategic locations throughout the HCA if it is deemed necessary. Vandalized signs will be replaced as they are encountered. Each sign explains that the HCA is a dedicated open space, and that off-highway vehicle (OHV) activity, dumping, and shooting are prohibited.

3. **Access Roads.** Both Denning Road, and the access road east of Huff/Hidden Canyon, will be graded and repaired as necessary to provide safe and effective access to the HCA.

B. BIOLOGICAL SURVEYS

The following section outlines monitoring activities planned for the next fiscal year. All data will be entered or stored in GIS and/or MSexcel databases. A brief description of monitoring activities outlined by taxa is provided below.

1. Vegetation Sampling in Thread-leaved Brodiaea Populations

In 2012, the Center completed a 5-year study on the effects of herbicides on thread-leaf brodiaea (TLB). This experiment also allowed the Center to study the ratio of flowering to vegetation TLB. Using the latter results, the Center is now developing and implementing an index plot methodology across Carlsbad TLB populations to fine tune and develop a model of flowering to vegetative ratios to better monitor and determine population sizes and changes over time (Appendix 3). Therefore, a selected set of plots from the 5-year study will be used as long-term index plots and monitored in the winter (vegetative) and spring (flowering) of 2013.

2. Vegetation Sampling within San Diego Thornmint Occurrences

The Center developed a monitoring methodology in 2008-2009 fiscal year to monitor the San Diego thornmint occurrence located at the Greens. This methodology has since been utilized for the last three years and will again be utilized during the current fiscal year. The sampling methodology includes stratified random sampling within the thornmint occurrence to collect data on percent cover, abundance, and diversity of native and non-native plant species. Monitoring transects are randomly placed within the previously demarcated boundaries of the occurrence and quadrats are then randomly placed along these transects and data were collected within each quadrat.

3. Orcutt's Brodiaea Survey

A focused survey for the presence of Orcutt's brodiaea (OB) at the Winston parcel will be conducted. The Winston parcel received two, separate transplant populations (one as part of the University Commons (UC) project and one as part of a separate transplantation project). Although OB from the UC were observed after transplantation, none were seen in 2012, and only a few in the last few years. None were observed as part of the other transplantation. In sum, the proposed surveys will determine if these translocations have succeeded or failed.

4. Long-term Coastal Sage Scrub (CSS) Monitoring

As per the Plan, the Center has a goal of sampling long-term CSS monitoring plots to track changes in the CSS community. In 2005, the Center set up vegetation transects stratified by fire history, distance from edge and vegetation sub-association. We used those data to direct our current action and plan (Appendix 4). We established the majority of our CSS plots per the CSS monitoring plan during 2008-2012 fiscal years, and we finished monitoring all of the established plots during the spring of 2012 (i.e. each plot has been monitored at least once. Selected plots will be sampled in the spring of 2013.

5. Orcutt's Hazardia

In 2004, the Center out-planted 200 Orcutt's hazardia (OH) from the Manchester Habitat Conservation Area in Encinitas (from collected seed). As of 2012, 156 adults have survived, and several seedlings have been observed. OH will be counted (adults, seedling and juvenile) in the summer of 2013.

6. Wildlife Corridors

The Center will monitor wildlife movement in several locations (east of Rancho Santa Fe Avenue, and on the Huff parcel in Copper Canyon) using digital remote sensing cameras. These cameras are deployed at pre-established camera stations.

The Center has been able to track wildlife movement through designated and potential wildlife corridors using these data gathered from the cameras.

7. California Gnatcatcher Presence/Absence Surveys

Presence/absence surveys for the California gnatcatcher (CAGN) will be performed in March and April following protocols established by CNLM and the City of Carlsbad. The surveys will cover approximately 75-100 acres per visit. A minimum of two surveys per area will be conducted. Additional surveys will be added, if necessary, to ensure data accuracy. All suitable habitat will be surveyed.

8. Genetic Studies

In mid-2011, CNLM was awarded a SanDAG EMP grant to conduct a range-wide genetic and common garden study of San Diego thornmint throughout San Diego County. In 2012 CNLM collected San Diego thornmint seeds from the HCA occurrence and other occurrences in San Diego for the common garden study. In 2013, CNLM will collect plant material for the genetic portion of the study. Results and management recommendations will likely be completed in the fall of 2013.

C. HABITAT MAINTENANCE AND RESTORATION

1. Habitat maintenance. Habitat maintenance will continue during this current fiscal year. Since 2002, many individual non-native plants and broad areas infested by non-native plants have been treated by CNLM. The Center will use money allocated from our budgets to treat the non-native plants, monies received from the TransNet Environmental Mitigation Program, as well as funds received from the Vallecitos Water District and Morrow Development (Morrow).

The following non-native plant removal projects will occur in the upcoming fiscal year and will be carried out using money allocated through the Center budgeting process:

- Remove approximately 50 eucalyptus (*Eucalyptus* spp.) and acacia (*Acacia* ssp.) trees on Denk Mountain. Methods will likely rely on "drill and fill" (with herbicide) or cut and stump spray.
- Treat onion weed (Meadowlark population), Ward's weed (Greens population), and perennial veldt grass (*Ehrharta calycina*) (Greens population and the old Rancho Santa Fe population if funds permit).
- Treat fennel (*Foeniculum vulgare*), artichoke thistle (*Cynara cardunculus*), pampas grass, tamarisk, ice plant (*Carpobrotus* spp.), onion weed (*Asphodelus fistulosus*), and tree tobacco (*Nicotiana glauca*) as they are encountered throughout the HCA.
- Continue to treat about ½ acre of pampas grass at the Brouwer parcel and all of the pampas grass located on the Greens parcel as resprouts are observed.
- Continue to treat resprouts of fountain grass (*Pennisetum setaceum*), castor bean (*Ricinus communis*), acacia (*Acacia* spp.), and blue-eye cape-marigold (*Dimorphotheca sinuata*) should they occur along the old Rancho Santa Fe Road.
- Continue to treat any remnant or newly sprouted Italian thistle in the Orcutt's brodiaea habitat at the Winston parcel and the thread-leaf brodiaea population at the Greens (population located closest to the Research Study Macroplot #1).
- If budget permits, control using post-emergent spot applications and hand pulling, the non-native annual weeds that are growing in the San Diego thornmint occurrence.

Transnet Grant – Weeds

In early 2009, the Center applied for grant funding through the TransNet Environmental Mitigation Program. The Center was awarded approximately $50,000.00 to remove nonnative plants at the Greens and Meadowlark parcels over a three year period. The term of the grant ends in December of 2012, but CNLM has asked for an extension as there are still unspent funds. The remaining funds are for pepperweed removal at the greens. So if the extension is permitted, pepperweed will be treated several times during the year.

Vallecitos Water District – Weeds and Restoration

The Center received compensatory funds from the Vallecitos Water District for wetland/riparian vegetation impacts at the North County Habitat Bank (Center-owned HCA in Carlsbad) in 2009. As part of the agency mitigation requirements, Vallecitos Water District was required to remove all non-native riparian plants from a wetland area located on the Greens parcel north and west of the Poinsettia and Alicante Avenue intersection. Additionally, VWD was required to enhance the wetland area by planting arroyo willow (*Salix lasiolepis*) cuttings in the same area where non-native plant removal occurred. The non-native plant removal was performed in October 2009 (through 2012) and the arroyo willow cuttings were planted shortly thereafter. The Center has monitored the non-native plant treatments and the arroyo willow growth and in 2012, CDFG and ACOE agreed that the restoration had met success criteria. Not all funds were spent when sign-off was received and the Center would like to continue to restore this area. The Center will use these funds to remove nonnative species and plant additional willows or trees if necessary.

Morrow Development

Morrow Development (project proponent of the La Costa Villages Development) did not meet success criteria for its riparian restoration at La Costa Greens. As a result, the CDFG and ACOE required them give CNLM $4,000.00 to continue to treat resprouting exotic trees in Box Canyon including, but not limited to, acacia (*Acacia* spp.), shamal ash (*Fraxinus uhdei*), pepper trees (Schinus spp.), and eucalyptus (*Eucalyptus* ssp.). The regulatory agencies determined that treating all exotic trees in Box Canyon and providing CNLM with money to continue to treat resprouting exotic trees for the next two to three years, would be sufficient for Morrow to receive release from their regulatory permits. Morrow Development first treated all exotic trees in Box Canyon in summer 2011. No activities were needed in 2011-2012. About ½ of the $4,000.00 will used in 2012-2013 to treat

of the above mentioned species that are located throughout Box Canyon and in the tributaries to Box Canyon.

2. **Habitat Restoration.** The Huff and Hubbard Restoration sites have been completed and no further remedial measures are necessary at this point. However, there are a few thousand dollars left for the Huff site. CNLM will use these funds to either remove nonnative species or maintain the access road (cut brush back).

   During the spring and summer of 2011, City Ventures, a local developer, worked with CNLM staff to choose restoration and enhancement locations on the Greens parcel as mitigation for a City Ventures Development planned for the southwestern corner of El Camino Real and Poinsettia Avenue. City Ventures is mitigating for project impacts on the Greens parcel because no other mitigation opportunities could be located within the Coastal Zone. As such, the regulatory agencies decided that mitigation could occur just outside of the Coastal Zone on the Greens parcel.

   City Ventures started the restoration project in late spring 2012 and completed their installation period and started their 5-year monitoring period. HRS, Inc, is the restoration biologist and Jessie Vinje, is the supervisor. CNLM staff will continue to work with Jessie and HRS to ensure project success.

3. **Erosion Control.** In 2011 and 2012, CNLM noticed soil depositing into the browditch along El Fuerte (just west of Alga Street). Staff walked the hillside and realized that there is another browditch about 50 feet above the one along the road and that the upper ditch was completed clogged in dirt. As a result, stormwater (concentrated from the large outfall above) was topping over the upper ditch and eroding soil into the lower ditch. In the winter of 2012, all the soil was removed from the upper ditch and gravel bags were inserted to direct water along the upper browditch. Gravel bags were also located in eroded areas of the slope. In addition, silt fence was installed in several areas along the lower browditch to keep soil from going into the street and sidewalk. This system worked well and far less soil was deposited into the lower ditch. In early summer, several mule-fat cutting were placed into the eroded area as additional erosion control measures. The areas will be maintained during the winter months.

   For many years soil eroded onto the Xana Way street and sidewalk as a result of a broken browditch. At this time, funds do not permit the repair of this browditch. However, in 2012, straw wattles were installed at the toe of the slope, which has kept soil from eroding onto the sidewalk and street. These wattles will be maintained as necessary.

4. **Fuel Zones.** Fuel zones will be mowed and cleared by the middle of May, 2013.

D. PUBLIC SERVICES

Public services activities include patrols, response to emergencies, trail maintenance, sign and kiosk maintenance and public outreach.

1. **Patrols.** Patrols will be performed approximately once to twice per week during the winter months and almost daily at Box Canyon during the summer.

2. **Emergency Response.** Staff time has been allocated from the current budget for management to respond to emergencies. Such emergencies could include response to wildfires, wildlife problems reported by neighbors, and trespass.

3. **Nature Walks/Outreach/Trails**. During this fiscal year, the Center will maitain blocked-off/unwanted and illegal trails on Denk Mountain and in the Box Canyon area. The Center will continue working with the San Diego Mountain Biking Association to maintain existing trails. The Center started trail planning for Copper Creek, which included meeting with wildlife agencies, talking to neighbors and discussing options with the County of San Diego Parks and Recreation Department. The Copper Creek trail planning will continue during the year.

   Neighboring home owners associations (HOA) have been important to the success of HCA management. The CCR's for these developments require that nonnative invasive plant species are removed from HOA common areas. CNLM staff have requested that nonnative species be removed from these common areas at the Greens, slopes north of the Elfin on-site parcel, and several other location, and the HOA's have been remarkably compliant. The primary problem is pampas grass. Center staff will continue to work with these HOA's to have the nonnative plants removed.

4. **Signs and Kiosks**. The Center intends to perform maintenance on, or relocate, several of the large wooden signs installed in around the HCA. This includes sanding and painting the large wooden signs located along Ranch Santa Fe Road and San Elijo Road. In addition, the sign at San Elijo road may be moved to a more conspicuous location, since it is not easily viewable in its' present location.

   Should time and funds be available, the Center would also like to sand and paint the kiosk located at Sitio Salvia. Also, several of the kiosks located at the Greens are not in good locations and will either be removed or relocated. All kiosks received new materials in the summer of 2012. Additional materials will be inserted roughly quarterly or as needed.

E. CONSERVATION EASEMENT COMPLIANCE

Current CE's include the Pfau CE near Frank's peak, Lot 8 of University Commons and the Elfin on- and off-site properties. The HCA Manager will monitor compliance of all areas of the CE to ensure the conservation values are maintained in perpetuity. Center practices for monitoring and reporting on CEs is derived from the CE agreement, CNLM's CE enforcement policy, and Land Trust Alliance standards (through which CNLM is an accredited land trust). A baseline report is prepared on a preserve, or on the portion where the CE exists, and then annual monitoring (or as often as stipulated in the CE) occurs to document any changes in the baseline condition. This process insures CE's are being managed appropriately, and ensures continuity of process. Compliance visits are to be carried out during the later portion of the management year, and are filed under a separate cover.

F. REPORTING

Activities included within reporting requirements include the management of the HCA's database/GIS system, the photo-documentation stations, and the production of various status reports to the USFWS, CDFG, City of Carlsbad and Center administration.

1. Database/GIS Management

Data derived from routine patrols and photo-documentation will be entered into and maintained in the HCA's existing database/GIS system. Additionally, the vegetation GIS layer will be updated based on the new vegetation maps and metadata will be added because currently, there are no metadata associated with the GIS vegetation layer. Efforts will be made to coordinate and standardize database fields and parameters with other reserves.

2. Reports

a. **Year-End/Agency Reports** By November of 2013, a year-end report will be prepared by the Preserve Manager detailing the results of the year's management activities. This report will include recommendations for the continuation of various activities for the following fiscal year and will be submitted to the County of San Diego, City's of San Marcos and Carlsbad, the USFWS and the CDFG as required under permit reporting conditions.

b. **Annual Work Plan** The work plan for the 2013-2014 fiscal year will be formulated by October, 2013 and will be based upon experiences during previous years' operations. This work plan will be submitted to the County of San Diego, City's of San Marcos and Carlsbad, USFWS and CDFG.

c. **Management Plan** The management plan for the HCA was updated in November 2011 and was submitted to the County, City's of San Marcos and Carlsbad and the wildlife agencies at the end of 2011. It will serve as the management plan until 2015-2016, at which time it will be revised.

G. OFFICE MAINTENANCE

HCA Management will maintain offices in an organized manner to facilitate maximum efficiency. This section of the budget includes outlays for general office work, utilities, and telephones, among other items/tasks.

H. OPERATIONS

Operations include the training and professional growth of Preserve Management personnel and inspection of the HCA by Center administration. Funds have been allocated in the current budget for both the Preserve Manager to attend an organization-wide Retreat, management-related training or seminars, and/or conferences during the fiscal year. Also included within this category of activity is the conduction of employee reviews.

III. WORKLOAD AND BUDGETS

A. SUPERVISION & STAFFING

The Preserve Managers and Rangers will be supervised by the San Diego Regional Manger, Markus Spiegelberg, and by the Center's Director of Conservation Science (DCS), Dr. Deborah Rogers. Tasks and priorities will be coordinated by the San Diego Regional Manager and approved by the DCS. Additionally, Dr. Rogers will assist with document review and scientific research conducted on Center preserves.

B. BUDGETING

The total budget for this fiscal year is (based on the interest generated from six endowments and the initial and capital from one project, (Cassia Professional Offices): Nelson, La Costa Villages, University Commons (Brookfield Development), Cassia Professional Offices, Elfin Forest (Scandia Development portion of University Commons),Meadowlark and Copper Creek are: $3,255, $65,702, $28,878, $4,421, $5,308, $436 and $26,290, respectively.

The Center received $50,000 as part of the purchase agreement for Copper Creek, and will receive a total of about $850,000 in Initial and Capital, and Endowment in four separate, but equal, payments from the City of Carlsbad. The City's contribution fulfills some of their HMP requirements which was approved by the wildlife agencies.

Every effort will be made by the Center to allocate time and expenses according to these estimated budgets.

IV. REFERENCES

CNLM 2011. Rancho La Costa Habitat Conservation Area Habitat Management Plan 2011-2015. November, 2011.

Sproul, F., T. Keeler-Wolf, P. Gordon-Reedy, J. Dunn, A. Klein, and K. Harper. 2011. Vegetation classification manual for western San Diego County. SANDAG, CA.

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V. APPENDICES

Appendix 1 - Task Schedule

Task	October-December 2012	January-March 2013	April- June 2013	July-September 2013
Non-native Plant Removal	X	X	X	X
Rare Plant Surveys; Collection of Genetic Research Plant Material; and Rare Plant Vegetation Analyses			X	
Establish and Monitor CSS Vegetation Plots		X	X	
Wildlife Monitoring	X	X	X	X
Restoration and Maintenance Activities	X	X	X	X
Clear Fuel Breaks			X	
Report and Plan Preparation; GIS Database Work; Conservation Easement Compliance	X			X
Patrol HCA; Public Outreach	X	X	X	X

Appendix 2 - HCA Location Maps

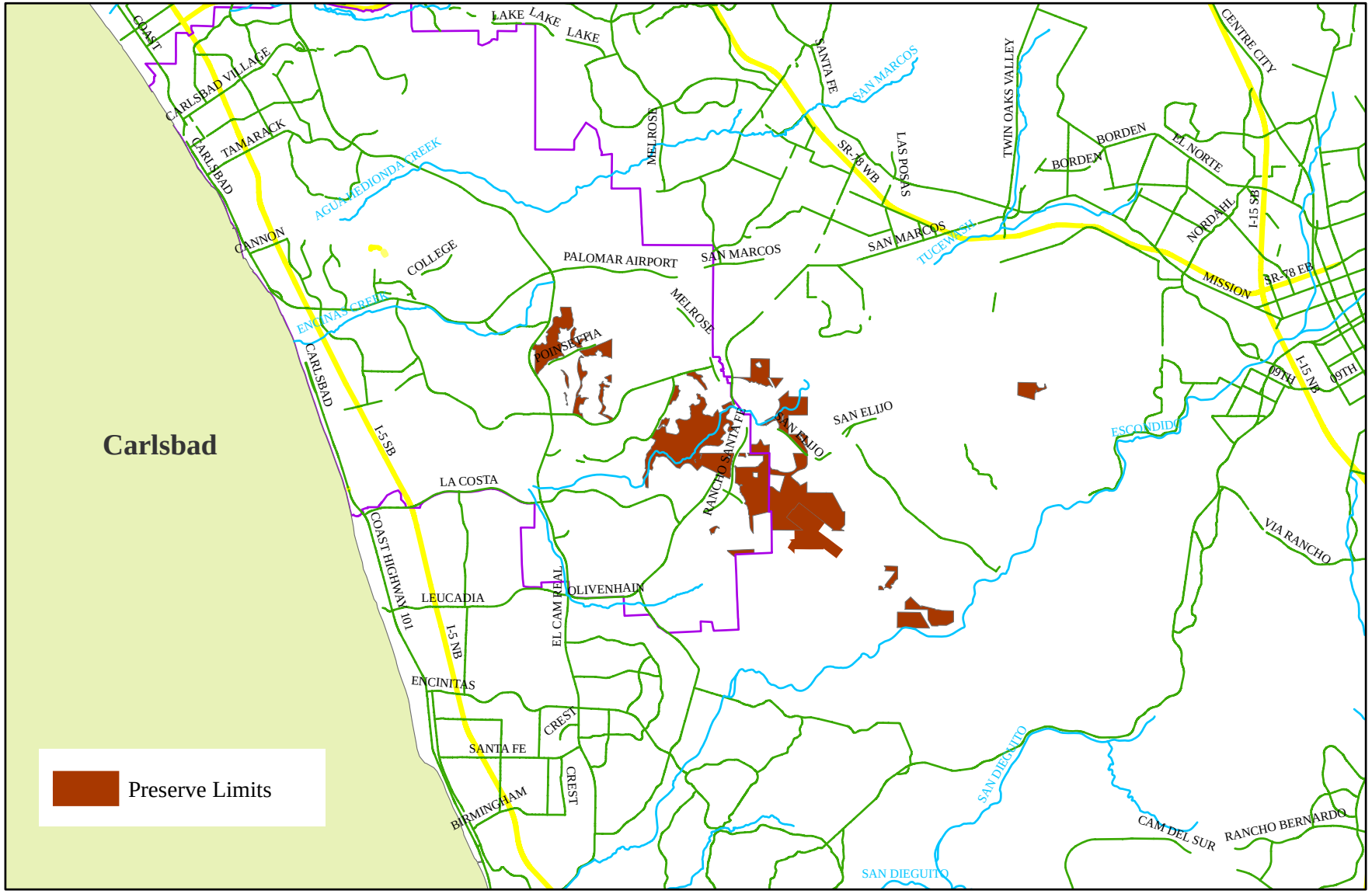

Figure 1. Preserve Location

Rancho La Costa Habitat Conservation Area- San Diego, California

Center for Natural Lands Management

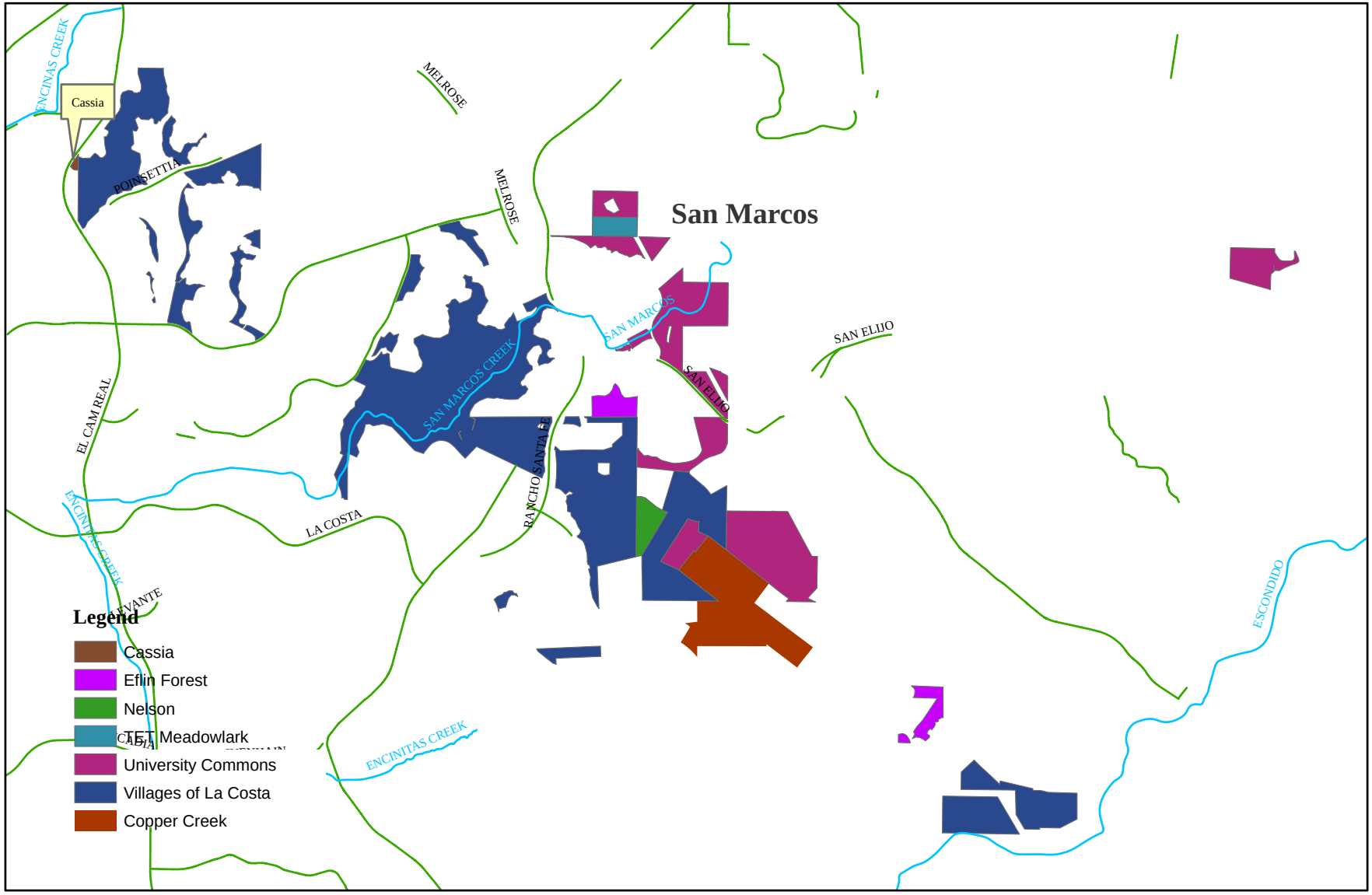

Figure 2. Preserve Vicinity

4,100 2,050 0 4,100 Feet

Rancho La Costa Habitat Conservation Area- San Diego, California

Center for Natural Lands Management

Appendix 3 - Thread-leaf Brodiaea (*Brodiaea filifolia*) Monitoring Methodology

Center for Natural Lands Management Thread-leaf Brodiaea (*Brodiaea filifolia*) Monitoring Plan

I. Background

Thread-leaf brodiaea (*Brodiaea filifolia*) (TLB) is a federally listed as threatened species and California State listed as endangered. TLB occurs on three Center for Natural Lands Management (CNLM) Preserves and one California Department of Fish and Game (CDFG) Reserve. CNLM-owned or managed preserves include Rancho La Costa (RLC) (The Greens parcel), Village H of Calavera Hills/Robertson Ranch (Calavera), and Carlsbad Oaks North (CON). The CDFG Reserve is Buena Vista Creek Ecological Reserve (BVCER). CNLM owns RLC and CON and manages via Conservation Easement the Calavera Preserve and the BVCER. CNLM is required to monitor TLB populations per the Multiple Habitat Conservation Program (MHCP) Monitoring and Management Plan (CDFG, USFWS, & CBI, 2003).

TLB is a corm bearing species and many TLB occurrences and thousands of TLB individuals are distributed in both a clumped and patchy nature throughout the non-native grassland habitats on CNLM owned or managed preserves. As such, annual TLB flowering response varies drastically depending on weather, site conditions and site location making population counts and estimations difficult and in many cases, inaccurate. Additionally, CNLM would not be able to directly count all of the TLB known to occur on RLC due to the large population, and simply counting these individuals would not benefit TLB in the long run. Population estimations for large rare plant populations, such as TLB on RLC, could also yield unreliable trend information (McEachren and Sutter, 2010a). The proposed trend within the MSCP for monitoring large, rare plant populations, that are difficult to count or sample, is to develop an "index of population and habitat condition that can be repeated over many years with the goal of showing the long-term range of natural fluctuation within which conservation management must operate" (McEachren and Sutter 2010b). This can be achieved by distributing permanent "index plots" in occupied rare plant habitat (McEachren and Sutter 2010b).

CNLM has been monitoring the TLB occurrence on RLC since 2005. Monitoring began on Calavera Hills/Robertson Ranch, Carlsbad Oaks North, and BVCER mostly since 2007. Monitoring has included direct population counts and estimations and habitat assessments. A research project testing the effects of weed management techniques on TLB and nonnative grasses was also initiated in 2006 at RLC (CNLM 2010).

II. Purpose and Objective

Purpose

At RLC, several large TLB occurrences were included in the monitoring and/or weed management research project (CNLM 2010); however, many TLB patches and many TLB plants in other portions of RLC were not included in either the annual monitoring or research project because the research project required copious amounts of time. No time was left to monitor the remaining TLB patches; although these patches were visited each year and in some cases, direct flowering counts were conducted. Additionally, a method to track attribute information in other TLB patches on CNLM preserves was also needed. This method should also be used to establish baseline habitat conditions and to track change within occupied TLB habitat over time. CNLM has decided to use index plots, as described in McEachren and Sutter (2010a) to monitor the TLB occurrences on CNLM owned and managed preserves. The Index Plot method is not intended to estimate population density, but rather, to track annual variation in both vegetative and flowering production over time and relate these data to environmental variables for modeling purposes.

Objective

Track the vegetative and flowering density, species richness, and cover among TLB patches on CNLM preserves using subjectively placed monitoring index plots. Additionally, identify observed or potential threats (i.e., soil saturation, soil erosion, anthropogenic impacts) within or adjacent to each Index Plot. Use this information to identify environmental correlations within TLB occurrences, track occupied TLB habitat changes over time, and to inform management decisions for occupied TLB habitat on all CNLM owned and managed preserves.

III. Methods

Install permanent monitoring plot indices in pre-determined TLB patches on CNLM owned and managed preserves. Preserve Managers can subjectively choose the index plot locations based on the distribution and density of known TLB patches. TLB patches to be targeted should include a diverse range of site conditions, including sites in the northern CNLM-managed preserves and sites in the south; sites that are closest to developed areas that are subject to edge effects (e.g., supplemental irrigation from landscaped slopes); sites that are spatially distributed on upper and lower slopes; and sites that are composed of different dominant plant species. For example, three Index Plots would likely suffice at the RLC HCA based on TLB geographic patch distribution. A smaller number of Index Plot general locations will likely suffice for Calavera and BVCER because these locations aren't as spread out or dense as at RLC. Complete counts within each Index Plot should be collected on an annual basis until such time that a model may be developed that suggests maximal conditions for assessing population status. Plots will continue to be assessed annually for cover estimation (visual only) by species, and species richness. Annual counts should occur until the locations and annual counts are numerous enough to build a model that is predictive of best rainfall and temperature conditions for complete counts of either vegetative and/or flowering.

1) Index Plot Size and Locations

Index Plot size and location will vary based on the distribution and density of TLB. The index plots have been, and will be subjectively placed to ensure that TLB is located within each Index Plot. Each index plot shall be placed to capture the most TLB present in that patch. For example, if TLB is distributed in a band that is perpendicular to the slope on which it occurs, then the Index Plot will also be placed perpendicular to the slope making sure to capture the majority of the TLB in that patch. Each index plot will receive its own unique identification number, or name beginning with the Preserve name or acronym followed by the number within that preserve; then the frame count within that site. For instance, at Calavera Hills Village H location already installed, and working one's way downhill, the first frame location will be Calavera1TLB1, and continued in this manner. As an additional site is expected to be installed, this will be Calavera2TLB1, 2, etcetera.

1a. RLC

The size and shape of index plots at RLC and CON will vary, depending on previous survey efforts and the size of the localities under study. For RLC, two 4 x 10 meter plots that are part of each experimental unit should be sampled so that counts can stay consistent with previous efforts. The third Index Plot will be subjectively placed in the large occurrence west of Goldstone St., to the north of the SDGE access road, as indicated on Figure 1.

1b. Calavera, CON, and BVCER

The Index Plot sizes at Calavera, CON, and BVCER will be smaller due to the fact that these TLB populations cover a much smaller extent. The number of index plots and the size for each of these two preserves has already been determined by the Preserve Manager. At Calavera Village H, five locations were determined for individual sampling frames of ½ x 1 meter size. Carlsbad Oaks North received smaller frames of 4 x 5 decimeters, since the patches are quite small at this location. The same quadrat size of 4 x 5 decimeters was also used at the BVCER location in 2012, and this site is set up differently due to the density of this population and the small size. Vegetative and flowering counts have been collected at these locations. However, it is expected that another location at Village H will receive another series of quadrats, and/or possibly a location at Village X.

2) Permanent Identification of the Index Plot

At the Village H, and CON locations, opposite corners of each sampling frame were marked by rebar. BVCER has only one dense population, and this population (not yet proven to be TLB) has had a rectangle installed around it, so that a regular array of 4 x 5 decimeter meter quarats could be used. In the case of the belts at RLC, the index plots are already permanently marked on each corner with rebar. Mason string, or a tape measure can be used to delineate the boundaries of these index plots for the purpose of performing counts. All four corners of each index plot at RLC will be marked using a hand-held Geographic

Positioning System (GPS), the center of each sampling frame at the other preserves will be GPS'd, and maps will be made using an aerial photograph so that surveyors can find the index plot in future surveys.

3) Density

Within each quadrat at Calavera Hills and at CON, a total count of all vegetative and flowering TLB will be collected every year. Vegetative counts will occur in late January/early February and flowering counts will occur in mid-May. Identify what a TLB individual is (i.e., Large (adult) vegetative TLB usually have 3-5 overlapping leaves. Small (young) TLB usually only produce one or two small leaves that are usually not overlapping). Rules for which plants will be counted and not counted will be established. This includes edge rules for whether or not a TLB plant will be counted if it falls directly under the index plot boundary edge so that future biologists can count within the same index plot boundaries using the same rules. For example, count all individuals that are rooted within the index plot.

For RLC, the following explains the reasoning, choice of, and method of reliably counting tlb:
Belts had to be chosen based on whether they were hit by broad-spectrum herbicide during late spring 2012 by ACS Habitat Management, Inc. Ideally, control belts would have been the maximal belts from which to continue counting in. Based on experimental results from the previous four years of applicable data, during the 2012 season, only herbicide and control belts were counted. However, in both macroplot 1 and macroplot 3, most control plots received some herbicide application over TLB, and henceforward, counts based in these plots will no longer be representative of natural variability. Only one control belt was left untouched in each macroplot. In macroplot 1, only belt 10 (control) was unaffected by herbicide application. Therefore, to keep some balance among those continuing counts, one control and one herbicide belt was chosen in each macroplot in order to continue counts. The counting method will continue with a flip-flop of vegetative counts, and to remain comparable to previous year's counts for RLC, these will need to be multiplied by two. Following this, in the late spring, all flowering within the belt will be counted. The following lists the beginning points utilized throughout the experiment for gathering vegetative counts, as one faces in the direction indicated:

Macroplot 1, belt 10, Control: facing south, start between zero and one on the right hand side of belt, with the long axis of a ½ x 1 meter quadrat facing away from the observer

Macroplot 1, belt 5, Herbicide: facing south, start between zero and one on the right hand side of belt, with the long axis of a ½ x 1 meter quadrat facing away from the observer

Macroplot 3, belt 12, Herbicide: facing north, start between zero and one on the left hand side of belt, with long axis of a ½ x 1 meter quadrat facing away from the observer

Macroplot 3, belt 14, Control: facing north, start between zero and one on the left hand side of belt, with long axis of a ½ x 1 meter quadrat facing away from the observer

Appendix 4 - The Center for Natural Lands Management - San Diego: Coastal Sage Scrub Monitoring Plan

The Center for Natural Lands Management-San Diego: Coastal Sage Scrub Monitoring Plan (Revised in 2012)

Objective: Track the changes in structure and composition of the coastal sage scrub (CSS) community.

a. Use data to evaluate the structure and composition of the CSS vegetation community and its correlation to predictions of vegetation changes based on theories postulated by ecological and threats models.
b. Use data to evaluate changes or trends in "populations", presence/absence and/or occupied/unoccupied habitat of sensitive animal species, primarily the coastal California gnatcatcher (*Polioptila californica californica*)(CAGN).
c. Use data to evaluate changes in species richness.
d. Use data to evaluate changes over time from a baseline vegetation pattern.
e. Use data to guide vegetation management decisions (i.e. non-native plant removal, rare species range increases/introductions).

Background of Need:

The Center for Natural Lands Management (CNLM) manages several thousand acres of CSS in San Diego County. These areas host many threatened, endangered and sensitive plant and wildlife species, provide for wildlife movement and are some of the last remaining stands of CSS in coastal San Diego. These areas were also specifically designated as important areas to conserve under the regional Habitat Conservation Planning (HCP) conservation efforts.

As a result, the CNLM needs to be able to evaluate recruitment and vigor of this vegetation community over time to guide management decisions and to evaluate changes in plant and animal communities. This monitoring will also provide an opportunity to evaluate theorized predictions of changes in vegetation communities resulting from urbanization, non-native species invasion, global warming, increased edge, altered fire regime and fragmentation (to name a few).

Background of Ecological Model and Threats

CSS is a fire-adapted vegetation community with fires occurring naturally, but most severely under the extreme Santa Ana heat and winds of late summer and fall and during drought conditions. During these conditions there would generally be a "complete burn" where all above ground vegetation within the fire's path would be consumed. After such a fire, herbaceous plants (fire followers), which are known to sprout after fires, would dominate the landscape for a few years. Over time (3-5 years) the shrub lands would regain their dominance, and after 5-10 years a mature assemblage of plants and wildlife would again be found on site (Dallman 1998).

The fire frequency in CSS is as frequent as chaparral due to the volatile oils and resins that occur in CSS plants. The plants, such as white sagebrush (*Saliva apiana*), are able to resprout after a fire or produce many seedlings from the dormant seed bank that lies in the soil. Seed germination of some species may also be stimulated by fire (Holland and Keil 1995, Dallman 1998). However, if the fire frequency and intensity are too great, plants in the CSS community, such as black sage (*Salvia mellifera*) and California sagebrush (*Artemisia californica*) are permanently killed and can no longer regenerate, slowly converting the CSS community to a non-native, annual grassland (Southwest Division, Naval Facilities Engineering Command 1998).

Each CNLM preserve in San Diego has a different fire history and a different predicted fire future. For example, most of the Rancho La Costa (RLC) Habitat Conservation Area (HCA) burned in the Harmony Grove fire in October of 1996, while the Manchester HCA has not burned (except two very small fires) in its entirety since 1917. Prior to 1917 no data are recorded, so it is uncertain as to when the last significant fire event occurred in the Manchester HCA.

Regardless of fire history and the current vegetation characteristics, there are many realized or potential threats to the integrity of the CSS vegetation community (See RLC Habitat Management Plan CSS Ecological Model and Threats Section (CNLM 2005) that need to be evaluated including:

1. What is the effect of an altered fire regime at each HCA?
2. What is the potential effect of global climate change?
3. What are the effects of urban edge?
4. What are the effects of fragmentation and isolation?
5. What are the effects of altered wildlife usage patterns?

The answers to these threats questions lead to other questions that are associated with effects on ecological processes and patterns, such as:

1. Are the variables investigated representing a threat?
2. At what spatial scale are the variables representing a threat?
3. How do the effects of the threats listed above effect the distribution and abundance of sensitive plant and wildlife species?
4. How do the threats listed above effect the distribution of non-sensitive plants and animals?
5. How do the effects of each threat alter ecological processes?
6. How do the various measured factors interact?

Predictions

Fire. We predict that as a result of fragmentation, complete burns of preserves are now less likely and that there will be fewer, smaller fires resulting in a mosaic of CSS with various age structures.

Global Climate Change. We predict that rainfall patterns will change (likely decrease) over the next 100 years resulting in a lengthening of the fire season, increased frequency of lightening fires, increased frequency of drought, and areas burned. We predict:

1. Possible regime shifts (altered abundance and recruitment patterns in various native vegetation assemblages)
2. Altered invasion severity of exotic species due to changes from native-adapted variations in weather phenomena
3. Lowered native seedling survival of species due to changes from native-adapted variations in weather phenomena
4. Lowered seed and/or clonal production of future generations due to changes from native-adapted variations in weather phenomena
5. Negative interactions between native wildlife and changes resulting from the above mentioned predictions in vegetative cover

Habitat Fragmentation and Urban Edge. We predict that habitat fragmentation will reduce plant diversity and migration and/or genetic exchange between plant populations. This could affect the CSS community by reducing vigor within populations and eventually leading to extinctions of specific plant species. Habitat fragmentation has resulted in an increase of urban edge on all our preserves. We predict that this will result in increased pressures from non-native plant species, illegal vegetation clearing, dumping, erosion, and other threats that will change the vegetation structure and composition.

Monitoring Methodology

Approximately fifty plots will be established inside three of our preserves, and the number per preserve allocated by the amount of acreage currently occupied by CSS in each preserve. These plots will be placed in a stratified random manner across our preserves. Stratification will take into account:

1. Size of preserve
2. Slope and aspect
3. Distance from preserve edge/urban edge
4. Presence or absence of CAGN or San Diego horned lizard (*Phrynosoma coronatum blainvillii*)
5. Fire history

Plot Design and Setup

The original plot design was based on the Whittaker nested vegetation sampling design as in Stohlgren et al. 1995. The design of the Whittaker nested vegetation sampling plot deviated from that described in Stohlgren et al. 1995 by not including the 12 smaller 1-square meter rectangles. The dimensions of the modified Whittaker nested vegetation sampling Macroplot was 50 meters long by 20 meters wide. Originally, three smaller nested plots were placed inside the sampling Macroplot, the largest of these three was 20 meters long and 5 meters wide, placed in the center of the sampling Macroplot, with the

long axis corresponding to that of the Macroplot. The two other nested plots were at opposite corners of the sampling Macroplot, and were 5 by 2 meters in length, again with the long axis corresponding to that of the sampling Macroplot. The long axis of the modified Whittaker plots was set to cross the environmental gradient present at the sampling Macroplot location. Sampling was carried out for both continuous variables (percent cover by species) and non-parametric and semi-continuous variables (count of dead shrubs, species richness).

The sampling Macroplot design was modified in 2011 after data analyses revealed that less area could be sampled within each Macroplot. The two, 5 by 2 meter nested plots were deleted from the sampling effort and the 5 by 20 meter center, nested plot was reduced in size to 2 by 20 meters.

Point Intercept Data (Percent Cover)

Percent cover by species was gathered by running a point-intercept transect tape along the upper border of each Macroplot. The point-intercept transects were measured at half meter intervals, thus generating 98 "hits" along the long (50 meter) side of the Macroplot. Living plants were counted as a point or "hit," if a 1.5 millimeter dowel is intersected in the vertical plane by the living tissue of a plant. At each half meter, data pertaining to bare ground, rock, or litter incident with the dowel was also collected. Dead branches attached to a living shrub do not count as a "hit." If a completely dead shrub is incident to the dowel along the point intercept line, that shrub is noted by species (if possible) in a separate column from the living plant "hits." The hope is that this may generate information pertaining to large-scale shrub die-off, as has been recently noticed, but had gone quantitatively undocumented in the Rancho La Costa HCA.

The point-intercept transect measures will provide a method of quantifying change in abundance by species and edaphic cover that may also tie into species richness changes observed within the center, sub-plot. For instance, non-native grasses and/or litter cover changes may be predictive as explanatory variables in a multi-factorial analysis of the response variables mortality or species decline. Other variables that may be tied into a model explaining the measured pattern may include regional rainfall totals for the season and/or seasonal temperature averages, slope and aspect of Macroplots, fire history, and the presence or absence of animal herbivory.

Species Richness

Species richness was originally gathered inside the three, nested subplots located inside each Macroplot; however, as discussed above, in 2011, species richness was only collected in the nested center plot that was reduced in size from 5 by 20 meters to 2 by 20 meters. Each species occurring within the subplot was recorded. Plants were identified to species and subspecies whenever possible.

We obtained shrub counts in our nested subplots and in the Macroplot during our first year of sampling (N = 17 Macroplots), and found that any counting inside subplots and

the Macroplot, in addition to noting species richness cannot be supported on our HCA endowments. Collecting species richness in these subplots is the most time-consuming portion of each visit. It is important to include some density estimates on certain species in the richness plots. CNLM has not yet determined what species to gather density information on, but by spring 2012, a method will be used on a trial basis for inclusion as a permanent data collection strategy.

Other Data Collection Strategies

CNLM has not yet determined with any confidence in interacting with other monitoring programs whether vertical or horizontal structure will need to be included in future data collection strategies. SDSU's Institute for Monitoring and Management is designing a collection strategy to determine if measures of vertical or horizontal structure are worth collecting, or whether species presence and cover using the above described methods are equally predictive of Cagn territory and/or nesting choice.

Sampling intensity

CNLM met with Dr. Douglas Deutschman at San Diego State University to inquire into methods of maximizing our return from our effort. We could not afford to monitor more than approximately 20 Macroplots per year. Also, the effects of trampling could mislead our conclusions about trend over time if we re-visited the same sites every year over the course of many years. It is necessary to capture the yearly variation in conditions such as rainfall and temperature, and thus we knew that many replicates would be needed in order to capture meaningful patterns.

Dr. Deutschman suggested a "rotating panel" approach. This approach incorporates visiting a subsample of all Macroplots on a yearly basis, ensuring to balance the replicates according to aspect and to spread these replicates across the landscape in order to capture variation in weather or rainfall that may take place across our sample region. It was suggested that we re-visit eight Macroplots over the course of three years, while rotating 12 or more new Macroplots over the course of the three years. Thus, after the third year of sampling, roughly 50 plots have been visited, and the variation in measures among the eight re-visit Macroplots can be compared to the rotating Macroplots. In this manner we can judge if yearly re-visits are necessary in the long-term, or if more sites are needed each year.

For instance, one potential outcome is that the region in which we are sampling does not vary substantially in factors influenced by weather or disturbance, and that by stratifying sub-sampling across the region and visiting a subsample of the whole, we can adequately capture the variation in vegetative and species richness measures without overtaxing our annual budgets. Another potential outcome is that we will obtain substantial information from this rotating panel design to indicate how many more sites should be visited on a yearly basis to capture the yearly variation without visiting the entirety of our plots.

In November 2011, Dr. Deutschman performed a paired power analysis on the three years of consecutive data described above. The following table illustrates the sample size

needed to find x% change with 80% confidence. Since change in shrub cover and a corresponding change in non-native grass or forb cover is most important to the long-term success of Cagn, it would appear that 14 plots performed every year, on a three-year return interval, is are needed to determine long-term trend.

Paired t-test power analysis based upon an analysis that reduced standard deviation in order to account for paired design.

	Exotic forb	Exotic grass	Native forb	Native grass	Native shrub
20 % of mean value	1.35	2.54	1.95	.88	9.11
Effect size desired	5%	5%	5%	5%	10%
Annual sample size needed to detect effect size	14	12	13	4	12

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